

TJ
1175
A45
no. 1444

Engineering

Allis-Chalmers Company

Manufacturing

ENGINE STORAGE

Bulletin

Crushing and Cement Machinery Department

August, 1910

Catalog No. 113

Year of Issue A6-3

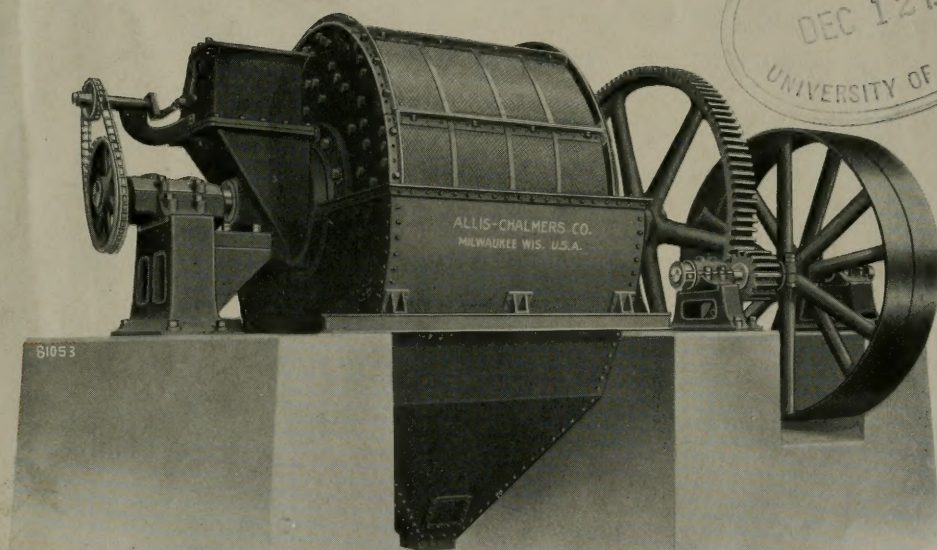
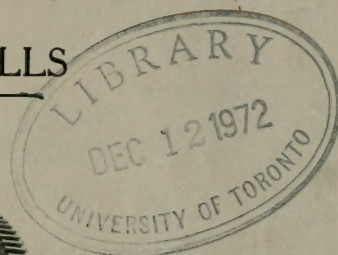
Please return to

Section No. 1910

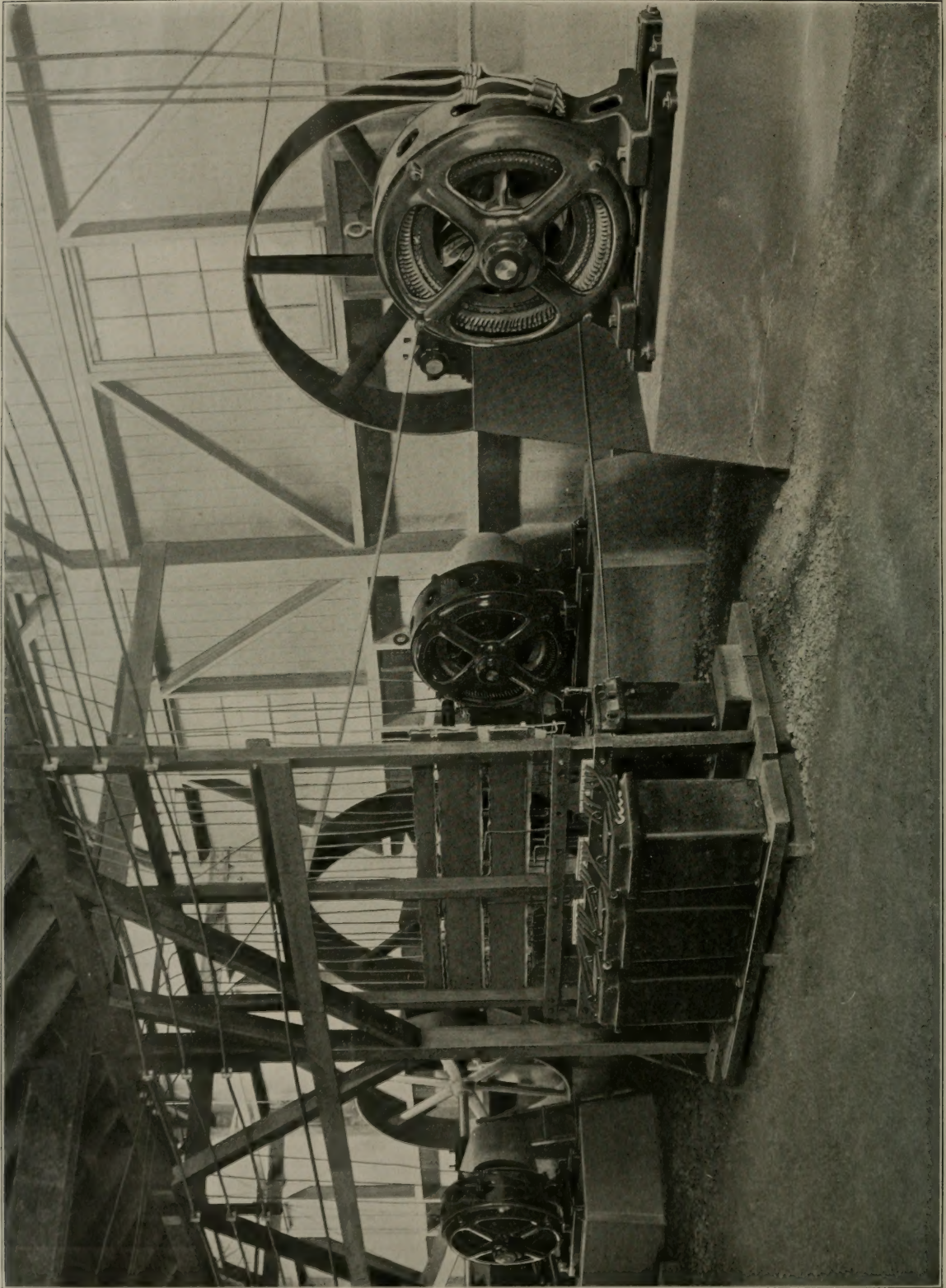
Catalog Library
Department of Mining Engineering

ry for Cement Making

MILLS AND TUBE MILLS



GATES BALL MILL WITH FEEDER ATTACHED
COMPLETE WITH HOUSING



Allis-Chalmers Induction Motors driving Tube Mills in Washington Portland Cement Co.'s Plant.

Cement Making Machinery

INTRODUCTION

Allis-Chalmers Company manufactures machinery for every stage of cement making by either wet or dry process, and its rock breakers, crushers, dryers, coolers, kilns, ball tube mills, ball mills, tube mills, elevators and conveyors are not surpassed in efficiency, durability and low cost for repairs. Unequaled facilities combined with many years of experience as designers and builders of complete plants, enable this company to place on the market machinery of superior quality and workmanship. Many successful mills in all parts of the country are completely equipped with Allis-Chalmers machinery, including all power and electrical apparatus, resulting not only in harmonious working of all machinery in every detail; but also eliminating entirely the disadvantages attendant upon divided responsibility.

To anyone contemplating the erection of a mill, large or small, this Company offers its experience and knowledge of the conditions for the manufacture of cement in the most convenient and economical manner by either process. Manufacturers desiring to improve their property, or extend present facilities either in the mill proper or power equipment, will best conserve their interests by conferring with Allis-Chalmers Company.

The following pages are devoted to descriptions of ball mills and tube mills, of which Allis-Chalmers Company is a pioneer builder. For information on additional machinery for use in connection with the manufacture of cement refer to the following bulletins:—

| | |
|---|-------------------|
| Large Breakers, No. 18-36" opening, No. 21-42" opening..... | Bulletin No. 1441 |
| Style "K" Gates Rock & Ore Breakers..... | " 1416 |
| Style "D" Gates Rock & Ore Breakers..... | " 1415 |
| Crushing Rolls..... | " 1412 |
| Rolls for Crushing Coal..... | " 1419 |
| Rotary Kilns & Storage Bins..... | " 1430 |
| Forged Steel Balls for Ball Mills..... | " 1406 |
| Ribbed Tube Mill Lining..... | " 1440 |
| Vertical Mill Elevators..... | " 1435 |
| Elevators, Screens, and Auxiliary Apparatus..... | " 1411 |

N.B.—Bulletins on Ball Tube Mills, Dryers and Coolers are in course of preparation.

Gates Ball Mills and Tube Mills

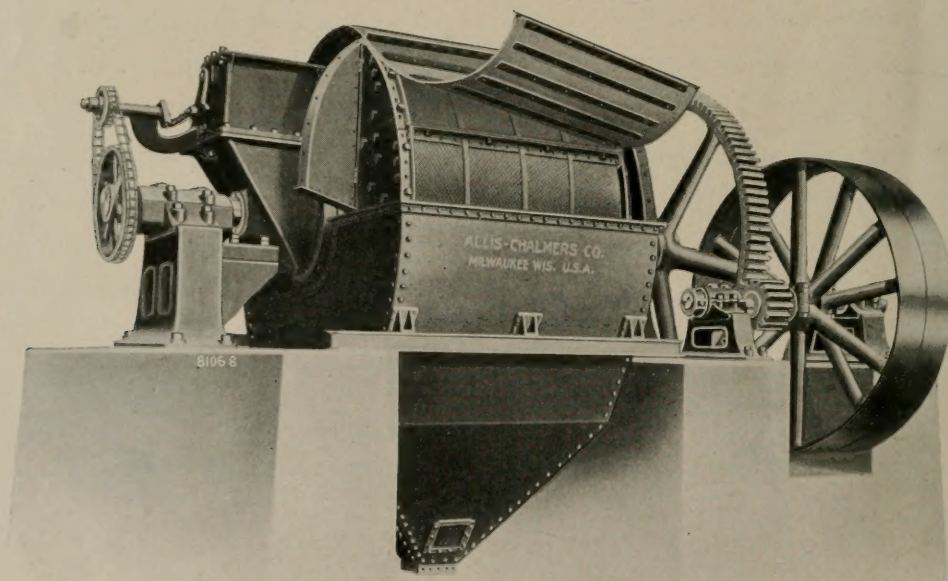
FINE PULVERIZING MACHINERY

The Gates Ball Mills and Gates Tube Mills are admirably adapted to the fine pulverization of dry raw materials, the latter serving simultaneously as an excellent mixer. Raw material must contain less than one per cent moisture to obtain the best results from tube mills.

Ball and tube mills are fully illustrated and described below. These two machines are used both for preparing the raw material and for grinding the clinker into finished cement. It is usually safe to estimate that the same number of these machines necessary to pulverize a given quantity of clinker to finished cement will be required for preparing the raw material. The increased capacity, due to easier grinding of the raw material, is equalized by the loss in burning.

Ball Mills were originally made to produce from very coarse material a finely finished product in a single operation. To accomplish this the outside or finishing screens were required to be of a corresponding fineness. After certain limits were reached, this resulted in a marked reduction of capacity and caused frequent stoppages, owing to the difficulty of keeping the very fine screens open. This is particularly true in the case of Portland cement making, where modern practice demands a product of which at least 92 per cent shall pass a 100-mesh screen.

Plate 7803



Gates Ball Mill, with Feeder Attached.

Showing upper portion of housing removed.

TABLE OF SIZES, WEIGHTS, ETC.

| Size Nos. | Weight without Charge Balls | Weight Charge of Balls | Capacity on Portland Cement Clinker to 20 M. | Horse Power Required |
|-----------|-----------------------------|------------------------|--|----------------------|
| 7 | 29500 lbs. | 3000 lbs. | 12 to 16 bbls. per hour | 30 to 40 |
| 8 | 41100 lbs. | 4500 lbs. | 18 to 24 bbls. per hour | 40 to 50 |

NOTE—From 100 to 120 per cent. additional power is required momentarily in starting the above machines. When pulverizing to pass all through 20-mesh, from 30 to 40 per cent. will pass a 100-mesh sieve.

The advent of the tube or pebble mill removed this objection, as it left for the ball mill only the work of preliminary reduction, say to 20 mesh. Up to this degree of fineness the ball mill had proven itself a most satisfactory and economical machine.

The ball mill consists of two circular side plates provided with inwardly projecting and eccentrically located shelves. The side plates have attached to them rigidly at their centers hubs which are mounted on a heavy shaft which revolves in dustproof bearings. One of the hubs has suitable openings through which the material is automatically fed by means of the Gates Patent Feeder.

Plate 1305



Balls for Ball Mills.

Forged from steel billets of special composition and extra hardness in following sizes:

- 2 inches Diameter.
- 2½ inches Diameter.
- 3 inches Diameter.
- 3½ inches Diameter.
- 4 inches Diameter.
- 4½ inches Diameter.
- 5 inches Diameter.

The 3½", 4" and 5" are furnished in our initial charge, one-third of each by weight. In use usually the 5" are added to replace the wear, the grinding action of the mill producing the necessary smaller ones to partially fill the interspaces.

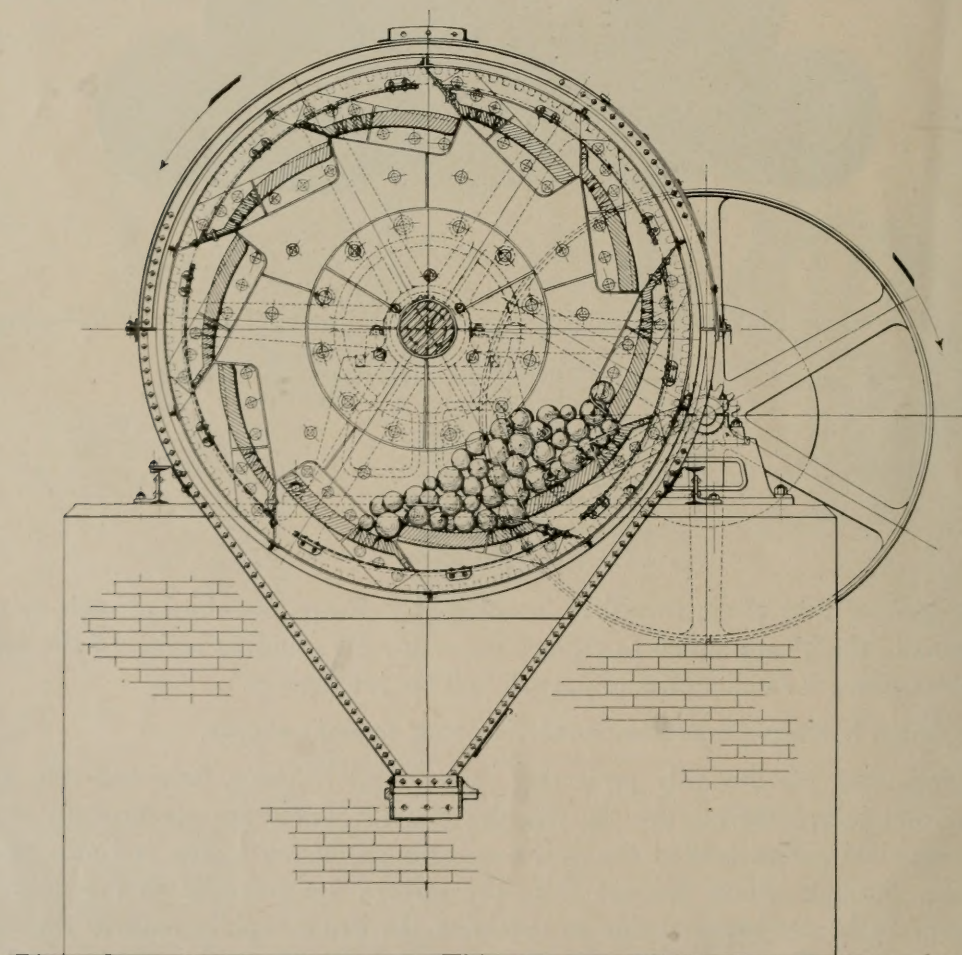
Get Allis-Chalmers prices before ordering your season's supply.

Resting upon the inwardly projecting shelves and reaching from one side plate to the other and bolted thereto are the wearing plates. These are eccentrically arranged so that one plate passes behind the next one, thus producing a step and also providing an opening through which residues from the screens are returned to the mill. The tumbling of balls and material due to revolving the drum rapidly reduces the material to fine grit and powder, the steps serving to greatly increase the beating action of the balls against the material.

When partially reduced, the ground product falls through apertures in the wearing plates to the first screen. The rejections from this screen are promptly returned to the mill through the openings between the overlapping plates, while the fines go to the outside finishing screen, and what passes through falls into the dust-proof housing and is removed by a conveyor or other means for final pulverization. The residues join those of the other screen and with them are returned to the mill and subjected to a further grinding action of the balls until they are fine enough to pass the outside or finishing screen. The wearing plates are each made in two sections, one plain and one perforated; the plain section, which wears the more rapidly, can be replaced one or more times, usually once, without replacing the perforated. These repairs may be effected by replacing one plate at a time, only removing the screens and without removing the charge of balls or disturbing the side plates or the balance of the mill in any way—an advantage contained in no other make of mill.

One great advantage of the ball mill over other types of preliminary grinders is its compactness, no elevator, outside screens and spouts or conveyor for return of rejections or similar complicated machinery being required.

Plate 7068



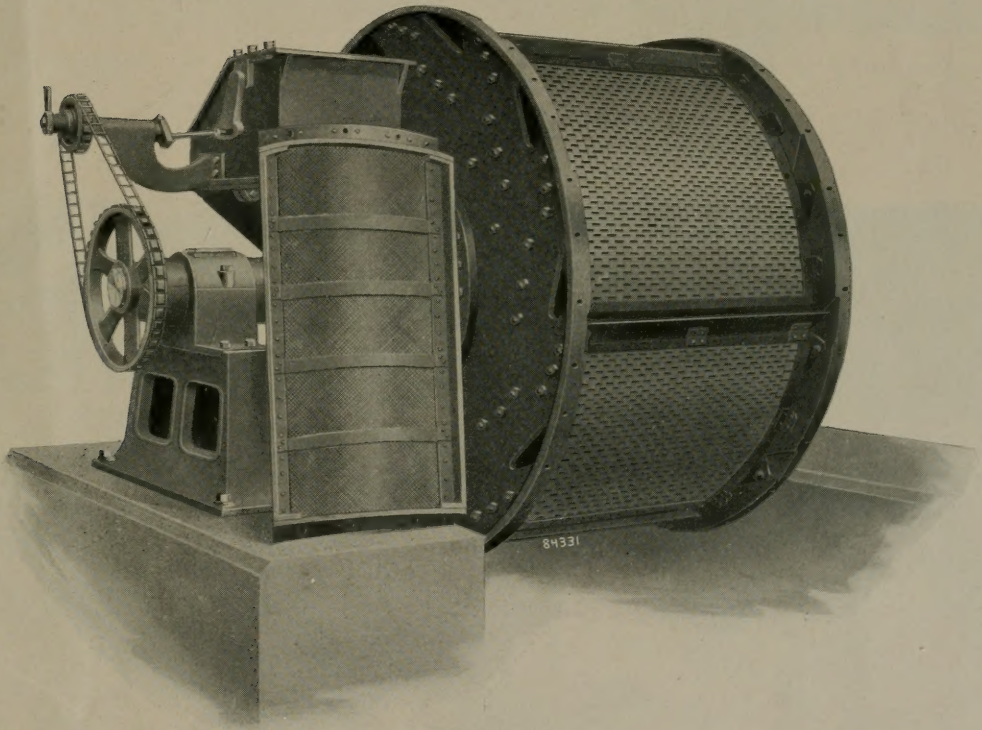
Transverse Section of Gates Ball Mill.

GATES PATENT BALL MILL FEEDER.

The Gates Swinging Ball Mill Feeder shown on the following pages is in the form in which it is regularly furnished with the Gates Ball Mill. A considerable number of cement manufacturers are using this type for feeding stone, clay, and other materials, where it is necessary to control the flow, and it is as successfully used for this purpose as for feeding ball mills.

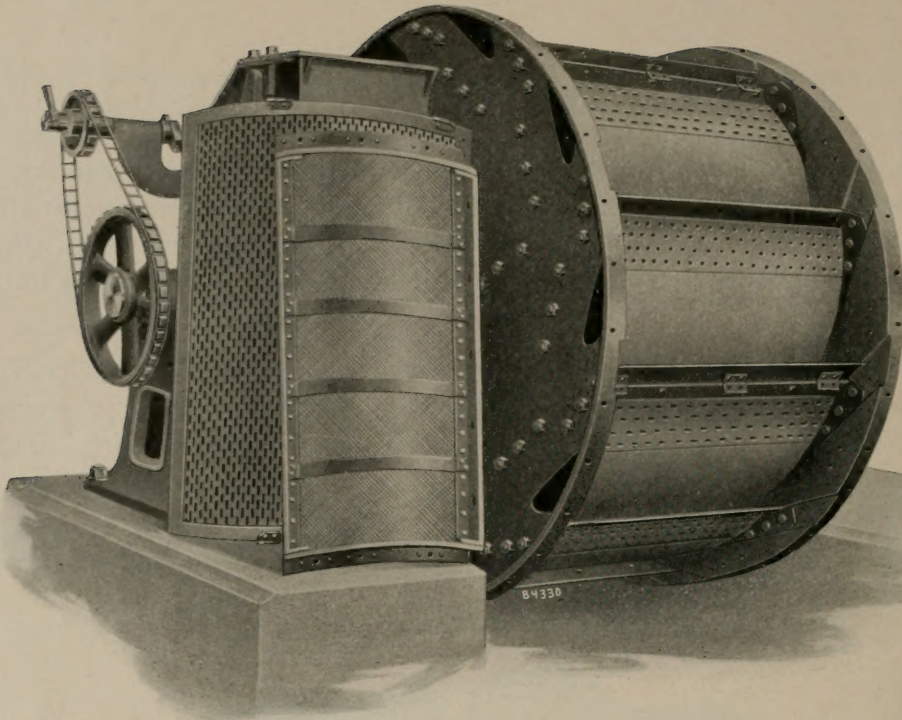
The Feeder is adjustable within a wide range by means of a slotted crank. The clutch on the sprocket or pulley provides a rapid and convenient means of stopping for adjustments, one hand being used for stopping, and the other for adjusting. This takes less time than it does to tell of it.

Plate 7804



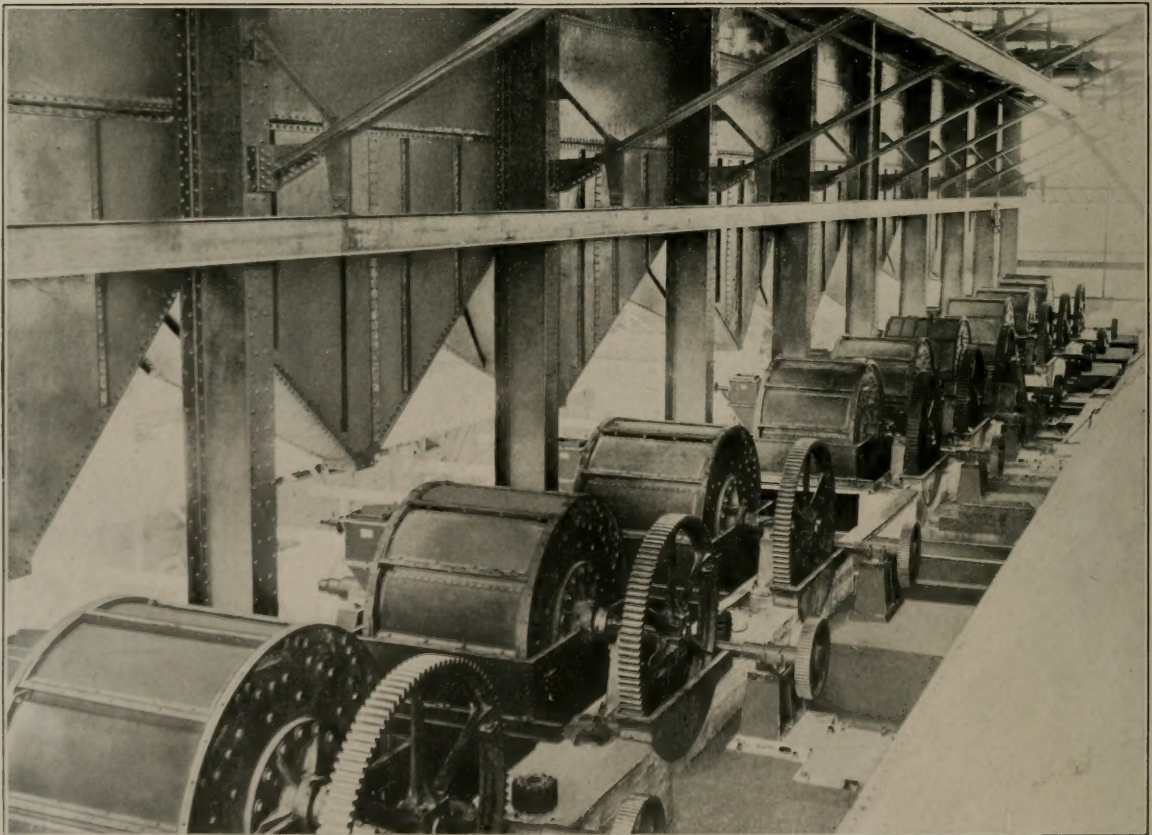
Gates Ball Mill, with Feeder Attached.

Showing first rejection screens in position, all other screens removed.

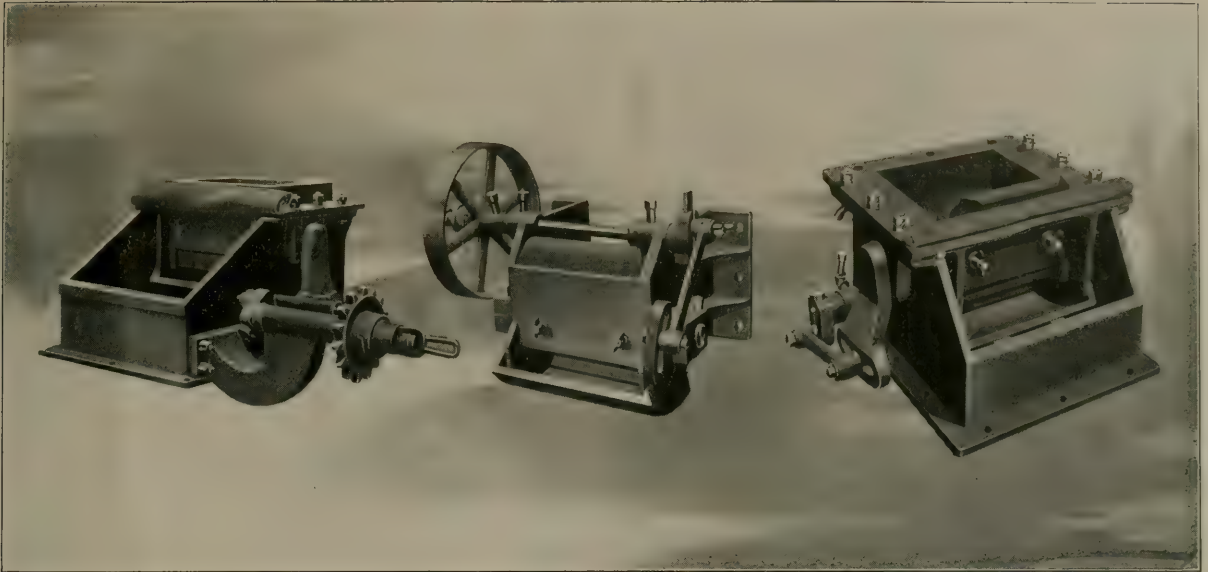


Gates Ball Mill, with Feeder Attached.
Showing grinding plates in position and all other screens removed.

Plate 3235



Gates Ball Mills during installation in Universal Portland Cement Co.'s Plant at Buffington, Ind.,
where they are in continuous operation.



Ball Mill Feeder

Wall Type Feeder

Regular H Style Feeder

TABLE OF "H" STYLE FEEDERS.

| Style | Width of feed | Size of receiving opening | Drawing or Sketch | Max. size rock | Approx. max. capacity per hour | Max. rev. per minute | Size driving pulley T-L. | Size driving sprocket with clutch |
|--|---------------|---------------------------|-------------------|----------------|--------------------------------|----------------------|--------------------------|-----------------------------------|
| Regular Style H Feeder similar to that shown in Plate 6124 above | 9" | 9" x 5½" | 18/55 | 1½" | 7,100 lbs. | 120 | 12" x 3" | No. 67-18 T-13¼" P.D. |
| | 12" | 12" x 12" | 9/168 | 2½" | 15,500 " | 100 | 12" x 3" | " 67-18 T-13¼" " |
| | 12" | 12" x 12" | 15/223 | 2½" | 15,500 " | 100 | 12" x 3" | " 67-18 T-13¼" " |
| | 14" | 14" x 12" | 4/195 | 3" | 20,500 " | 100 | 12" x 3" | " 67-18 T-13¼" " |
| | 16" | 16" x 14" | 3/71 | 3" | 21,000 " | 100 | 12" x 3" | " 67-18 T-13¼" " |
| | 16" | 16" wide | 6/99 | 3" | 21,000 " | 100 | 18" x 3" | " 67-23 T-17" " |
| | 24" | 24" x 18" | 1/78 | 3" | 40,000 " | 80 | 24" x 4" | " 67-30 T-22½" " |

Approximately one-fourth to one-half horse-power each to drive feeders. Speed may be varied to suit. Either tight and loose pulley or sprocket wheel and lever clutch furnished; pulleys furnished unless otherwise specified.

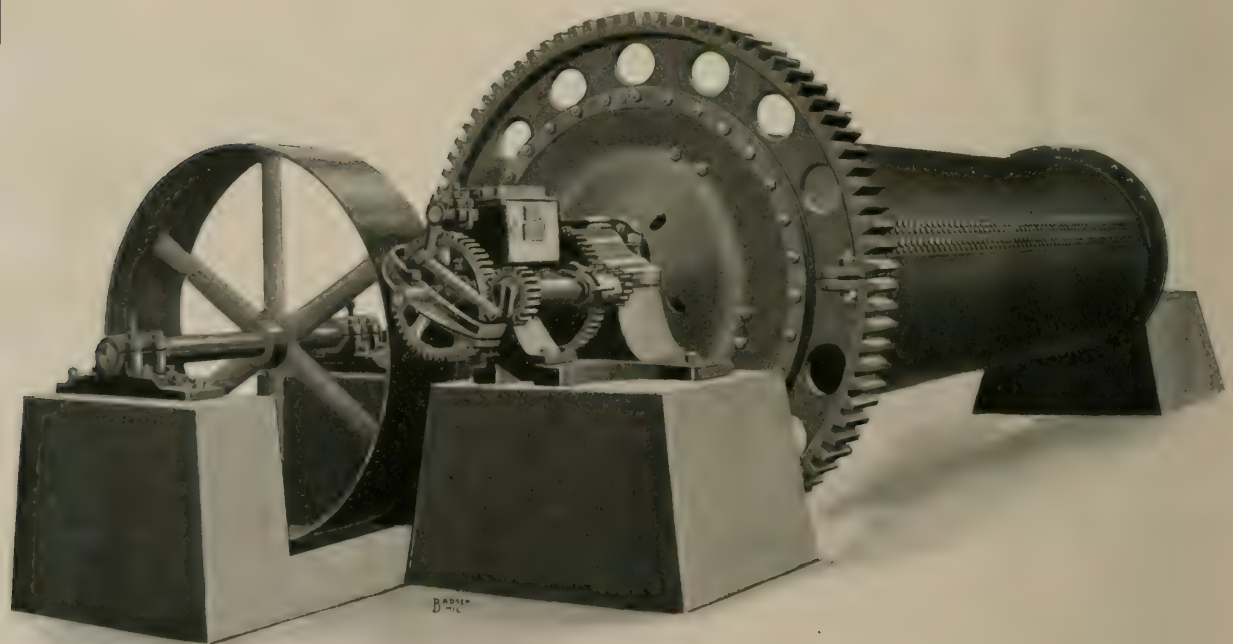
THE GATES TUBE MILL.

In cement plants using the dry process, which is generally acknowledged to be the best process in nearly every case, it has been found advantageous to prepare the raw material for the rotary kiln in tube mills in preference to any other form of grinder. Some plants have endeavored to do the grinding and mixing with other forms of grinding machinery, and have failed to a greater or less degree. In practically all the new installations in the West, if not throughout the United States, where the raw material is limestone and clay, or shale, or in other words, two separate materials, which have to be mixed, tube mills are being used for the fine grinding and mixing of these materials, preparatory to burning. There is no better mixer on the market than the tube mill; the advantage in the perfect mixing in some cases outweighs the grinding advantage contained in this mill over other types of fine grinders.

The advantage which comes with grinding the materials, as well as mixing them in the tube mill, is considerable. Upon the clinker end, the tube mill is not only the best machine for finishing the clinker into cement, but is of great assistance to a plant in making the product uniform and free from streaks of cement of varying fineness.

Portland cement clinker should first be reduced to at least 20 mesh, or finer in ball mill and finished to the market fineness, which is at least 92 per cent through 100-mesh

Plate 7249



Gates Tube Mill.

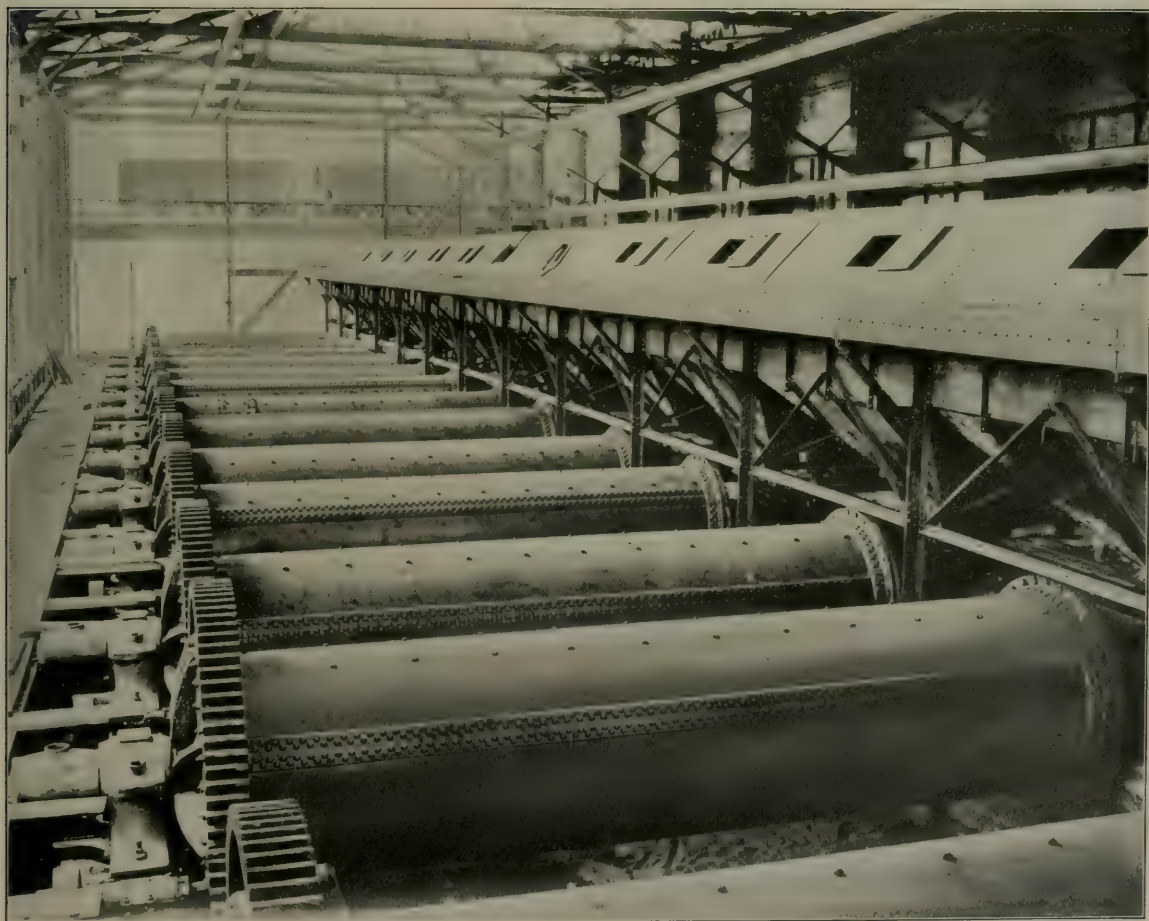
Showing feeder, spur gear drive and plam pulley, as applied at the feeder end.

If desired for simplifying driving connections, bevel gears are substituted for spur gears, or the whole driving gear can be placed at the discharge end of the mill.

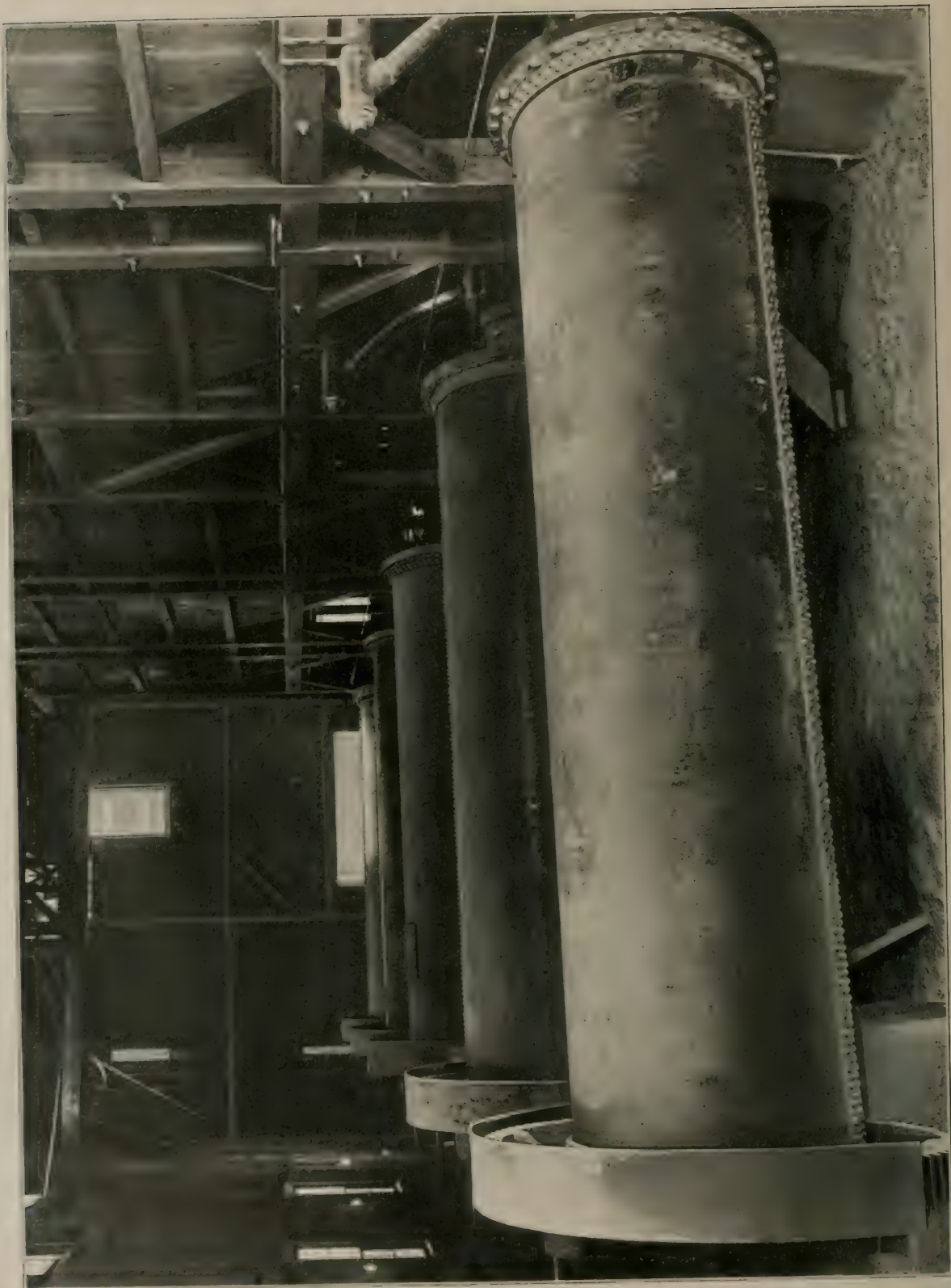
laboratory sieve, in tube mills. The modern requirements for cement are becoming more and more severe in relation to fineness of grinding, and specifications are beginning to include the amount of cement which must pass a 200-mesh screen. It is a well-known fact that cement pulverized in ball mills and tube mills contains a higher percentage of very finely ground cement passing a 200-mesh sieve than that produced by any other process, and as this fine material adds greatly to the sand-carrying capacity of cement, it increases likewise its real value. As this feature becomes better understood and appreciated by users, cement pulverized by this class of machinery will be preferred to any other.

The tube mill consists of a steel plate cylinder, provided with driving gear, which may be lined with any of the following linings: silex, a flint stone quarried in Europe; ironite, a dense close-grained stone, quarried in the United States; porcelain or chilled iron. Most of the Tube Mill users in this country in the cement industry favor the silex or ironite lining. At the ends it is closed by heavily reinforced cast iron heads, which have at their centers hollow trunnions through which the material is fed in at one end and discharged at the other.

Plate 3387



Clinker Grinding Room, Universal Portland Cement Company's Plant, Buffington, Ind.,
containing eighteen Allis-Chalmers Tube Mills.



Gates Tube Mills in Washington Portland Cement Co.'s Plant.

In operation the mill is filled to a point a little below its axis with material and pebbles and made to revolve, causing the mass of pebbles and material to tumble over each other with a wave-like motion, developing in this way an enormous grinding surface capable of reducing material to any desired degree of fineness, and this without screening. The slow speed at which the machine revolves makes its use especially desirable in the dusty atmosphere found in cement plants, and removes a prolific cause of many of the costly and annoying shut-downs incident to using high-speed pulverizers.

The most popular sized machine for cement work is our 5x22-foot mill.

Tube Mills are manufactured by Allis-Chalmers Company in the following sizes:

3½' x 14' in length

4½' x 20' in length

5' x 22' in length

5½' x 22' in length

6' x 22' in length

7' x 22' in length

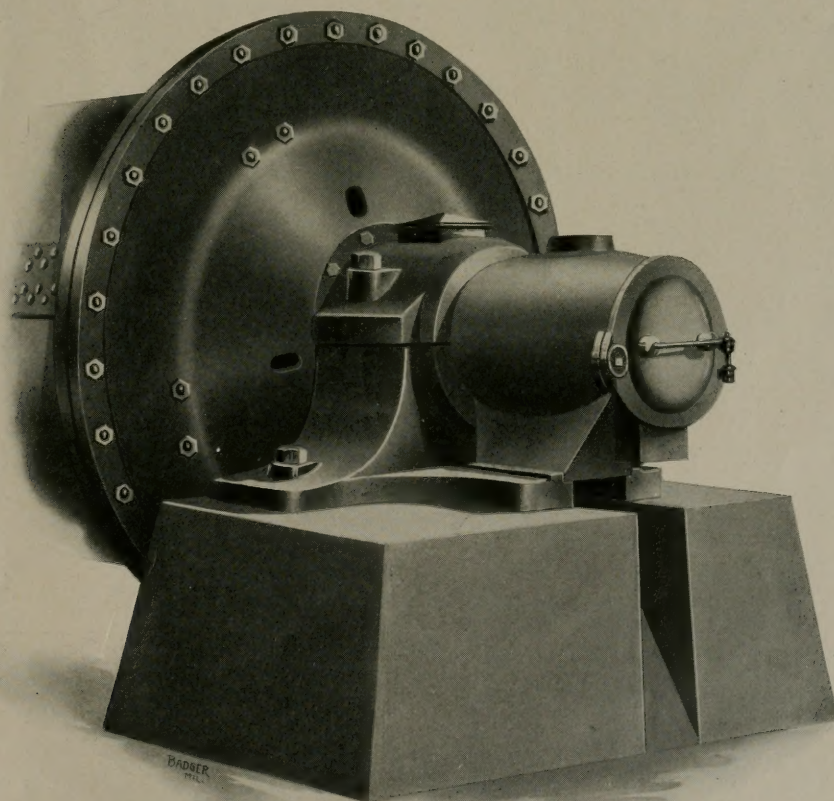
8' x 22' in length

We are prepared to manufacture mills of any length shorter than the above.

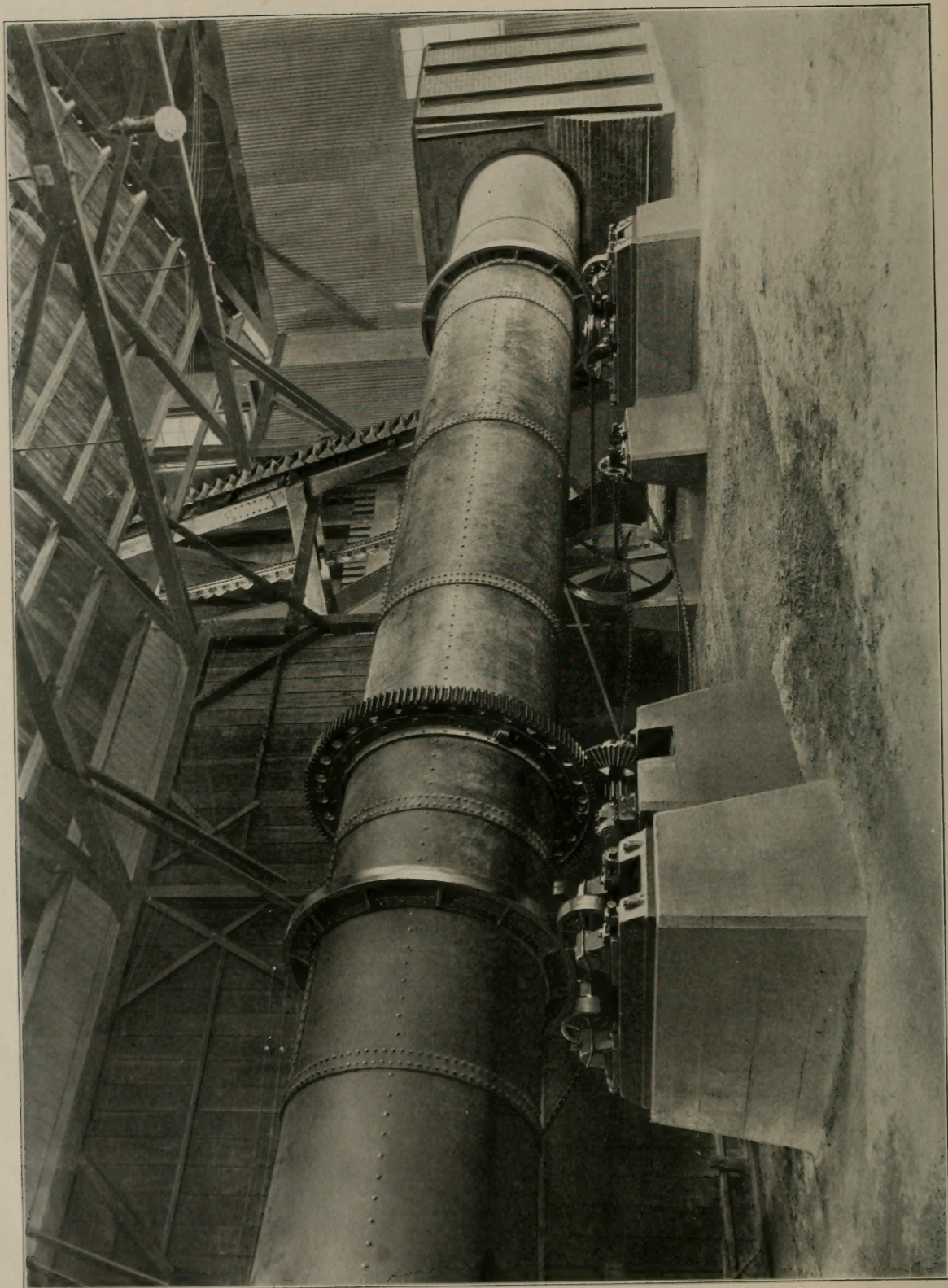
This machine, receiving a properly prepared feed of average Portland cement clinker, will pulverize from 14 to 20 barrels per hour, the quantity varying with the hardness, age and fineness of the clinker.

The 5x22-foot mill requires from 70 to 75 horse-power to operate it and about 125 horse-power momentarily for starting.

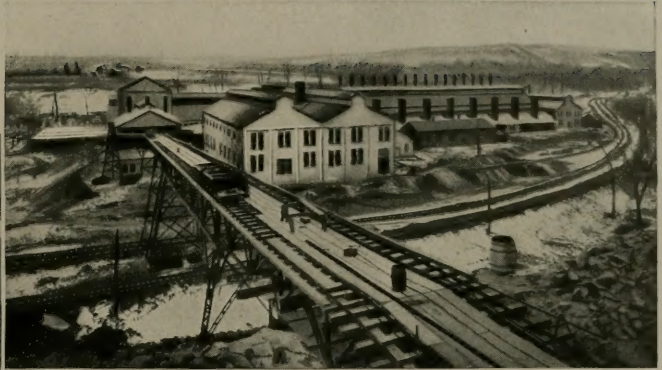
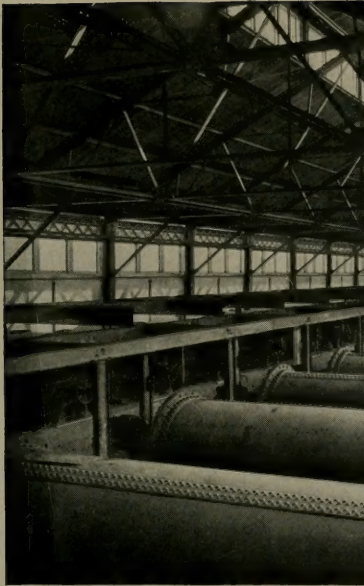
Plate 7250



Dustless Discharge as Fitted to all Gates Tube Mills for Dry Grinding.



Allis-Chalmers Dryer installed in Washington Portland Cement Co.'s Plant.
(A Bulletin on Dryers is being prepared.)



Bird's-eye view of
Alpha Portland
Cement Company's
Plant equipped by
Allis-Chalmers Co.

Grinding Room of Alpha Portland Cement Company's Plant, Martin's
Creek, Pa., where eighteen 5 ft. by 22 ft. Gates Tube Mills are installed.

DISTRICT OFFICES

Atlanta, Ga., Fourth Nat'l Bank Bldg.
Baltimore, Md., Continental Bldg.
Birmingham, Ala., Woodward Bldg.
Boston, Mass., 50 Congress St.
Buffalo, N. Y., Ellicott Square Bldg.
Chicago, Ill., First National Bank Bldg.
Cincinnati, O., First National Bank Bldg.
Cleveland, Ohio, Schofield, Bldg.
Dallas, Texas, Wilson Bldg.
Deadwood, S. D.
Denver, Colo., McPhee Bldg., 17th and Glenarm Sts.
Detroit, Mich., Union Trust Bldg.
El Paso, Texas, 129 San Francisco St.
Kansas City, Mo., Dwight Bldg.
Los Angeles, Cal., 129-131 E. Fifth St.

Minneapolis, Minn., Corn Exchange Bldg.
New Orleans La., Maison Blanche Bldg.
New York, N. Y., 71 Broadway
Philadelphia, Pa., Land Title Bldg.
Pittsburg, Pa., Frick Bldg.
Portland, Ore., 92 First St.
St. Louis, Mo., Third National Bank Bldg.
Salt Lake City, Utah, Dooly Bldg., 117-119 W. 2nd South St.
San Francisco, Cal., Jackson Bldg., Second and Natoma Sts.
Scranton, Pa.
Seattle, Wash., 115 Jackson Street.
Spokane, Wash., Paulsen Bldg.
Toledo, O., Ohio Bldg.
Washington, D. C., Evans Bldg.

Allis-Chalmers Company's

PRINCIPAL PRODUCTS

AIR BRAKES

AIR COMPRESSORS

Steam Driven
Belt Driven
Electrically Driven
Hydraulic Driven

BLOWING ENGINES

CEMENT MACHINERY

Ball Mills
Balls, Forged
Coal Pulverizing Machinery
Crushing Rolls
Elevators
Mixing Fans
Perforated Metals
Revolving Screens
Rock and Ore Breakers
Rotary Dryers
Rotary Kilns
Tube Mills
Tube Mill Linings
Tube Mill Pebbles

COAL MINING MACHINERY

Barney Cars
Crusher Rolls
Hoisting Cages
Revolving Screens
Shaking Screens
Ventilating Fans

CONDENSERS

Jet
Barometric

CRUSHING MACHINERY

Ballast Plants
Crushing Rolls
Dumping Skips
Gyratory Rock Breakers
Jaw Crushers
Macadam Plants
Perforated Metals
Portable Crushing Plants
Revolving Screens
Quarry Cars
Elevators
Hoists

ENGINES

Blowing Engines
Corliss Engines
Gas Engines
Hoisting Engines
Pumping Engines
Rocking Valve Engines
Rolling Mill Engines

FLOUR MILL MACHINERY

Bolters, Universal
Bolting Cloth
Bran and Shorts Brushes
Centrifugal Reels
Corn Mills
Feed Mills
Feed Screens
Flaking Rolls
Flour Packers
Hexagon Reels
Purifiers
Roll Corrugating
Roller Mills
Rolling Screens
Scalping Reels
Sieve Scalpers

GAS ENGINES

HOISTS

Steam Driven
Electrically Driven

HYDRAULIC MACHINERY

Water Turbines
Turbine Governors

MINING MACHINERY

Air Compressors
Chilian Mills
Concentrating Plants
Copper Converting Plants.
Crushing Plants
Cyanide Plants
Frue Vanners
Gold and Silver Mills
Gyratory Breakers
Hoisting Machinery
Huntington Mills
Jaw Crushers
Jigs
Lead Refining Plants
Mine Ventilating Machinery
Ore Buckets
Ore Cars
Ore Feeders
Prospecting Mills
Roasting Furnaces
Skips
Smelting Machinery
Stamps, Gravity
Stamps, Steam
Stamps, Atmospheric
Tube Mills, Wet and Dry

PERFORATED METALS

POWER TRANSMISSION MACHINERY

Belt Tighteners
Boxes
Couplings
Gears
Hangers
Pulleys
Rope Sheaves
Shafting

PUMPING MACHINERY

"High Duty" Pumping Engines
Centrifugal Pumps
Elevator Pumps
Fire Service Pumps
Geared Pumps
Hydraulic Transmission Pumps
Mine Pumps
Screw Pumps

SAW MILL MACHINERY

Band Mills, Double Cutting
Band Mills, Single Cutting
Band Re-saws, Horizontal
Board Lifters, Steam
Cant Flippers, Steam
Canting Machine, Overhead
Carriages
Circular Saw Mills
Conveying Machinery
Cutting Off Saws, Steam Feed
Edgers
Edging Grinders
Feeds, Steam, Direct Acting
Feeds, Steam, Twin Engine
Filing Room Tools
Lath Mills and Bolters
Live Rolls and Drives
Log Chains
Log Jacks
Log Loaders
Log Turners
Niggers, Steam
Rocking Valve Engines
Set Works
Slashers
Steam Feed Valves
Stock Lifters, Steam
Transfers
Trimmers

SUGAR MACHINERY TIMBER PRESERVING MACHINERY

TURBINES—STEAM

TURBINES—WATER

ELECTRICAL APPARATUS

ALTERNATING CURRENT GENERATORS AND MOTORS

Belted Type Generators
Engine Type Generators
Fly-wheel Type Generators
Turbo Generators

Water-wheel Type Generators
Synchronous Frequency Changers
Induction Motor Frequency Changers

Synchronous Motor-Generator Sets
Induction Motor-Generator Sets
Synchronous Motors

Induction Motors
Transformers
Rotary Converters

DIRECT CURRENT GENERATORS AND MOTORS

Belted Type Generators
Engine Type Generators

Small Bipolar and Multipolar Motors and Generators
Street Car Equipments, Motors, Controllers, etc.

Multiple Voltage Balancing Sets
Multiple Voltage Variable Speed Equipments

SWITCHBOARDS FOR DIRECT CURRENT AND ALTERNATING CURRENT